

Remarks

Reconsideration of this Application is respectfully requested.

Upon entry of the foregoing amendments, claims 1-9 are pending in the application, with claim 1 being the independent claims. Support for the amendments to the claims can be found throughout the specification, e.g., in paragraphs [0019] and [0021]. These changes are believed to introduce no new matter, and their entry is respectfully requested.

Based on the above amendments and the following remarks, Applicants respectfully request that the Examiner reconsider all outstanding objections and rejections and that they be withdrawn.

Rejection of claims 7, 8, and 9 under 35 U.S.C. § 112

Claims 7, 8 and 9 were rejected under 35 U.S.C. §112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter of the invention. First, the Examiner alleges that claim 7 recites a broad recitation "when said ceramic matrix requires a calcinations temperature of 400°C or lower," and also alleges that claim 7 recites a narrower range of "the calcinations is carried out...at 300-350°C." Applicants respectfully traverse this rejection.

Solely to further prosecution, Applicants have amended claim 7. The phrase "when said ceramic matrix requires a calcination temperature of 400°C or lower" has been deleted from amended claim 7. Thus, the rejection of claim 7 should be withdrawn.

Second, the Examiner alleges that claim 8 broadly recites "when said ceramic matrix requires a calcinations temperature of 400°C or higher," and that claim 8 recites a

narrower statement of "the calcinations is carried out...at 400-1,700°C." Applicants respectfully traverse this rejection.

Solely to further prosecution, Applicants have amended claim 8. The phrase "when said ceramic matrix requires a calcination temperature of 400°C or higher" has been deleted from amended claim 8. Thus, the rejection of claim 8 should be withdrawn.

Thirdly, the Examiner alleges that claim 9 recites the feature "it" in line 2, and that there is insufficient antecedent basis for the term "it." Claim 9 has been amended to replace the word "it" with the phrase "said ceramic mixture." Thus, the rejection of claim 9 should be withdrawn.

In view of the above amendments and arguments, Applicants request that all rejections under 35 U.S.C. §112, second paragraph be reconsidered and withdrawn.

Rejections under 35 U.S.C. § 102

Claims 1-7 and 9 were rejected under 35 U.S.C. §102(b) as allegedly being anticipated by Hwang *et al.* (*J. Mater. Chem.* 11:1722-1725 (2001)). Specifically, the Examiner alleged that the Hwang document teaches a process of forming a carbon nanotube reinforced nanocomposite as described in claim 1. Applicants respectfully traverse this rejection.

Amended claim 1 recites a method comprising:

- "(d) sonicating the dispersion of (c) *for 2 to 10 hours*; and
- (e) drying and calcinating the sonicated dispersion of (d), wherein said *water soluble salt forms a ceramic matrix post-calcination*; medium of (c) be sonicated for 2-10 hours."

(Emphasis added) Claims 2-7 and 9 depend from claim 1.

The Hwang document describes the addition of aqueous solution comprising cetyltrimethylammonium bromide (a surfactant) to carbon nanotubes (col. 1, last para.), and that the addition of a surfactant aids in the dispersion of carbon nanotubes (col. 1, first para.). Hwang notes that

In the presence of surfactants, CNTs form co-micelle structures with surfactant molecules (*vide infra*) via strong van der Waals interactions and can be well dispersed in the aqueous solution.

Col. 2, last para. If a surfactant is added to a solution comprising carbon nanotubes, the surfactant will coordinate on the surface of the carbon nanotubes and lessen the polar differences on the carbon nanotubes, preventing the water-soluble salts which form the ceramic matrix from being attached on the surface of the carbon nanotubes. Likewise, if a surfactant is used, during the calcination of the sonicated dispersion the surfactant will be vaporized or prolyzed, thus forming vapors between the carbon nanotubes and the water-soluble salt. Accordingly, a method for using a surfactant to disperse carbon nanotubes may prevent carbon nanotubes *from forming a ceramic matrix with the water soluble salts* post calcination, as featured by claim 1. Thus, Hwang does not teach drying and calcinating the sonicated dispersion, *wherein the water soluble salt forms a ceramic matrix*. Therefore, each element of claim 1 is not taught by Hwang.

Additionally, Hwang does not describe sonicating the salt dispersion for 2-10 hours. Rather, Hwang describes sonicating of the salt dispersion medium for 10 minutes (col. 1, last para.). The sonicating treatments of 2-10 hours are carried out to homogeneously disperse the carbon nanotubes and the water soluble salt dispersion medium, and to induce the formation of chemical bonds between the carbon nanotubes and the matrix at the molecular level as disclosed in the application at paragraph [0021].

Therefore, Hwang does not describe each element of claim 1, and the rejection should be withdrawn. Additionally, since Hwang describes the use of surfactants to aid in dispersion of carbon nanotubes, one of skill in the art would not be motivated to sonicate the salt dispersion for 2-10 hours. Therefore, in view of Hwang, the present invention is also not obvious. In view of at least the above arguments, the rejection of claims 1-7 and 9 under 35 U.S.C. §102(b) as allegedly being anticipated by Hwang *et al.* should be withdrawn.

Rejections under 35 U.S.C. § 103

Claim 6 was alternatively rejected under 35 U.S.C. §103 as allegedly being obvious in view of Hwang *et al.* Specifically, the Examiner alleged that Hwang teaches that the solution is to be placed in an autoclave and heated at "~110°C" or approximately 110°C. The Examiner acknowledged that claim 6 requires drying carried out at 80°C to 100°C. However, the Examiner alleged that drying said dispersant at approximately 110°C would obviously encompass drying dispersant in the temperature range of 80°C to 100°C since the latter range would yield materially equivalent drying effect. Applicants respectfully traverse.

To establish a *prima facie* case of obviousness, the cited document(s) must teach or suggest each and every element of the claimed invention. Claim 6 is dependent on claim 1. Proposed amended claim 1 requires that the carbon nanotubes in the salt dispersion medium of (c) be sonicated for 2-10 hours. Hwang does not teach or suggest that the salt dispersion be sonicated for 2-10 hours. Thus, each and every element of claim 1 is not taught or suggested by Hwang. Since claim 6 is dependent on claim 1,

then each and every element of claim 6 is also not taught or suggested by Hwang. For at least the above argument, the rejection of claim 6 under 35 U.S.C. §103 as allegedly being obvious by Hwang should be withdrawn.

Claim 8 was rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Hwang in view of Chang (U.S. Pat. 6,420,293). Specifically, the Examiner alleged that Hwang teaches that the SiO₂-CNT powder is to be calcinated in an N₂ atmosphere at 1050°C, which falls between the claimed temperature range of 400-1700°C. The Examiner acknowledged that Hwang fails to explicitly set forth that the calcination of the ceramic matrix should be performed under a high vacuum. However, the Examiner alleged that Chang teaches that the heating of carbon nanotube materials at elevated temperatures in an oxidizing environment typically results in chemical changes in the surface of the particles, and that both N₂ atmospheres and high vacuum environments are commonly utilized as non-oxidizing environments. Thus, the Examiner alleged that the high vacuum environment would be an obvious alternative to the nitrogen atmosphere in Hwang. Applicants respectfully traverse.

To establish a *prima facie* case of obviousness, the cited document(s) must teach or suggest each and every element of the claimed invention. Claim 8 is dependent on claim 1. Proposed amended claim 1 requires that the carbon nanotubes in the salt dispersion medium of (c) be sonicated for 2-10 hours. Hwang does not teach or suggest that the salt dispersion be sonicated for 2-10 hours. Likewise, Chang does not teach or suggest that the salt dispersion be sonicated for 2-10 hours. Thus, neither Hwang nor Chang teach or suggest each and every element of claim 1, either individually or collectively. Since claim 8 is dependent on claim 1, then each and every element of

claim 8 is also not taught or suggested. For at least the above argument, the rejection of claim 8 under 35 U.S.C. §103 as allegedly being obvious by Hwang *et al.* in view of Chang should be withdrawn.

Conclusion

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. Applicants believe that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment and Reply is respectfully requested.

Respectfully submitted,

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